

Recommendation of the Utah Association of Mathematics Teacher Educators August 2014 Secondary Mathematics Teacher Preparation

At the March 2014 annual meeting of the Utah Association of Mathematics Teacher Educators (UAMTE) a subcommittee of members was tasked with reviewing and making recommendations relative to Utah's levels 2, 3, and 4 mathematics endorsement based on the recent College Board of Mathematical Sciences (CBMS) report: The Mathematical Education of Teachers II. The committee met over the course of four months and shared information with their departments to unanimously recommend changes to each of the endorsement check lists. What follows is first an explanation for why we as a collective body of Utah mathematics teacher educators felt the endorsement structure needed to be reviewed. Second, an explanation for why the recommended changes are needed, and third, UAMTE's recommended revised checklists for the level 3 and 4 endorsement levels. Recommendations for the level 2 and Special Education endorsements are pending.

Rationale for Reviewing the Endorsement Check Lists

The decision to review the current course checklist was based primarily on recommendations within The Mathematical Education of Teachers (MET) II report. Specifically: Recommendation 1 states, "Prospective teachers need mathematics courses that develop a solid understanding of the mathematics they will teach. Prospective teachers need to understand the fundamental principles that underlie school mathematics, so that they can teach it to diverse groups of students as a coherent, reasoned activity and communicate an appreciation of the elegance and power of the subject. Thus, coursework for prospective teachers should examine the mathematics they will teach in depth, from a teacher's perspective." Additionally, Recommendation 5 suggests that mathematics educators and mathematicians work collaboratively to develop preservice teachers' understanding of the mathematics that they will teach.

The MET II document also makes specific recommendations about the coursework required of preservice high school teachers: "Prospective high school teachers of mathematics should be required to complete the equivalent of an undergraduate major in mathematics that includes three courses (9 semester hours) with a primary focus on high school mathematics from an advanced viewpoint." The MET II document goes on to state that "teachers will also need courses in mathematical pedagogy."

Taken as a whole, the UAMTE determined that it is necessary to examine the alignment between Utah's endorsement structure and the recommendations within the MET II report. Further, as a collective body of Utah higher education faculty in both mathematics and education, we take seriously our responsibility to work in partnership with Utah education professionals to ensure students in our state receive the best mathematics education possible. Lastly, the endorsement structure plays an important role in preparing teachers. As such it should be evaluated regularly for its alignment to Utah's needs.

Rationale for Making Changes to Endorsement Check List

Teachers need to develop two broad kinds of mathematical knowledge: 1) knowledge of advanced or higher mathematics and 2) deep knowledge of the mathematics they will teach in grades 7-12. There is some overlap between these, but courses on the former do not always help prospective teachers make the connections to the latter. Our proposed modifications focus on increasing the credit hours of courses that will help teachers develop the deep knowledge of the mathematics they will teach. The content of advanced mathematics courses which have traditionally served as a base for a mathematics teaching degree remains largely intact. We are recommending three courses (9 semester hours) that are focused on middle school and high school mathematics content from an advanced perspective.

Our recommendations follow the guidelines in the MET II document which calls for 9 semester hours of mathematics courses designed primarily for prospective teachers. CBMS describes these courses as treating high school (or middle school) mathematics from an advanced standpoint, taking up a mathematical terrain from school mathematics and developing it in depth, or developing mathematics that is useful to teacher's professional lives. These courses will address the mathematics content in a way that will promote connections between the advanced mathematics courses and the mathematics being taught in grades 7-12. This deep knowledge of the mathematics that prospective teachers will teach (which draws on concepts, reasoning, and skills from advanced mathematics) is the kind of knowledge that effective teachers draw on to deepen students understanding, increase their engagement, advance their reasoning, and hone their fluency.

Suggested Additional Course Requirements

Course 1: (3 semester hours) Middle School Mathematics from an Advanced Perspective: Many of the topics that first cause middle grades students great difficulty and become road blocks to further mathematical understanding are encountered in the middle school grades. This course should deepen prospective teachers' knowledge of rational numbers, ratio and proportion, meaning and use of variables, linear functions, and early geometry concepts. Preparing prospective teachers well to help students understand this foundational content will greatly improve students' ability to succeed in more advanced mathematics in high school.

Course 2: (3 semester hours) High School Mathematics from an Advanced Perspective: The Utah Core Standards have deepened the level of mathematics taught at the high school level. Prospective teachers will likely teach Algebra 1, Geometry, or Algebra 2 OR Secondary Math 1, 2 or 3 if they secure jobs in a high school; these courses are filled with content that most prospective teachers have not seen in at least 4-6 years. This course should deepen teachers' knowledge of functions (e.g., exponential, logarithmic, polynomials, rational, quadratic), inverses, and connections between different representations (e.g., graphs, tables, formulas).

Course 3: (3 semester hours) Statistics and Probability from an Advanced Perspective: Statistics and probability are increasingly important fields for all students to understand. The Utah Core Standards have increased the amount and focus of statistics and probability standards, both in the middle grades and in high school. A course that takes these concepts and deepens these concepts for prospective teachers is more important now than ever before.

It is important to remember that these are mathematics courses and not methods courses; therefore the focus of the course work will be on helping prospective teachers make connections between their advanced mathematics courses and the mathematics that they will be teaching in grades 7-12. We realize that adding three courses to a program is a difficult task, but many programs in the state already have existing courses (capstone courses, critical review of school mathematics courses, etc) that fill or can be adapted to fill the requirements of these courses. In such cases where adding these courses may require increased resources to develop and teach we feel that the increased resources will return a measurable increase in instructional effectiveness across the state.

Recommended Revised Check Endorsement Check Lists

Level 4

Calculus I (College Algebra and Trigonometry are prerequisite courses therefore implied)

Calculus II

Multivariable Calculus

Linear Algebra

Foundations of Analysis OR Advanced Calculus

Foundations of Geometry

Modeling/Applied Mathematics OR Differential Equations

History of Math

Middle School Math From an Advanced Perspective (for Teachers)

High School Math From an Advanced Perspective (for Teachers)

Secondary Statistics and Probability from and Advanced Perspective (for Teachers)

Methods

Level 3

Calculus I (College Algebra and Trigonometry are prerequisite courses therefore implied)

Calculus II

Linear Algebra

Foundations of Geometry

History of Math

Middle School Math From an Advanced Perspective (for Teachers)

High School Math From and Advanced Perspective (for Teachers)

Secondary Statistics and Probability from and Advanced Perspective (for Teachers)

Methods

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